use in DOD. The Army is at the forefront of DOD's BSC SRS effort. The SRS team is working directly with the Balanced Scorecard Collaborative, the firm founded and led by Drs. Norton and Kaplan, to more fully develop the methodology's potential through use of automation and database linkages that will ultimately be available on AKO. The SRS vision is to create an overarching, highly accessible Army information system that will provide leaders and staff with the ability to continuously assess all aspects of Army mission and readiness in near real-time.

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The Probability of Success Metric

LTC Bob Ordonio and Edmund Blackford

BEST BUSINESS PRACTICES

"The general who wins a battle makes many calculations in his temple before the battle is fought. The general who loses a battle makes but few calculations beforehand. Thus do many calculations lead to victory, and few calculations to defeat ... It is by attention to this point that I can foresee who is likely to win or lose."

Sun Tzu, *The Art of War*

Predicting program success has always been difficult. Some programs succeeded through inspiration, luck and determination while others struggle through their inception and never get off the ground. In 2002, Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT)/ Army Acquisition Executive (AAE) Claude M. Bolton Jr. directed that a method be developed that allowed "an accurate, comprehensive method of assessing a program's probability of success, and a process or briefing package that would allow this assessment to be clearly and concisely conveyed to Army leadership as quickly as possible once developed."

The ASAALT staff implemented an interim Probability of Success (P(S)) metric in June 2002. This method used a Point Estimate method to calculate the probability using an equal-weighted average of the evaluation factors. The evaluation factors include technical, schedule and funding factors. Currently, acquisition category (ACAT) I and II programs are required to submit a Point Estimate P(S) metric via the Monthly Acquisition

Program Review (MAPR) within Acquisition Information Management (AIM) services.

Simultaneous to implementing the Point Estimate method, the AAE requested the Defense Acquisition University (DAU) develop a method that would calculate the P(S). DAU, in conjunction with industry, academia and individuals who have served as program managers (PMs), determined that in addition to the traditional cost, schedule and performance metrics, other information was required to determine a program's P(S). DAU then formed an integrated process team to develop an alternate P(S). The DAU method provides a flexible and comprehensive calculation that includes programmatic and external factors. Additionally, the DAU method provides a more readable metric that includes coloration and an associated numeric rating and, ultimately, proves to be more robust in representing the program's health.

> Three internal quantitative factors — requirements, resources and execution — and two external qualitative factors — program fit and advocacy — are used to determine the program's overall health.

To validate and verify the DAU method, the ASAALT staff piloted the P(S) metric with Program Executive Office (PEO) Intelligence, Electronic Warfare and Sensors (IEW&S). The Aerial Common Sensor and Phoenix Battlefield Sensor System programs participated in the pilot programs. After the two programs at Fort Monmouth, NJ, successfully piloted the P(S) metric in 2003, the AAE selected the DAU method for implementation. The AAE's intent was to have all ACAT I and II programs submit a P(S) metric by second quarter FY04. Programs will then submit their P(S) metric on a quarterly basis thereafter.

As the acquisition community continues to automate many of its processes, oversight of program life cycle and budget occupy a majority of the information technology efforts. The ASAALT staff selected PM Acquisition, Logistics and Technology Enterprise Systems and Services (ALTESS) in Radford, VA, to accomplish the mission to automate the P(S) metric. Since some of the data used for P(S) is already entered through other applications in AIM such as Web Army RDA (research, development and acquisition) Budget Update Computer System (WARBUCS) and the Monthly Acquisition Position Reports, PM ALTESS reduced the PM's workload by using the existing data rather than having the program office enter redundant data. Single data entry

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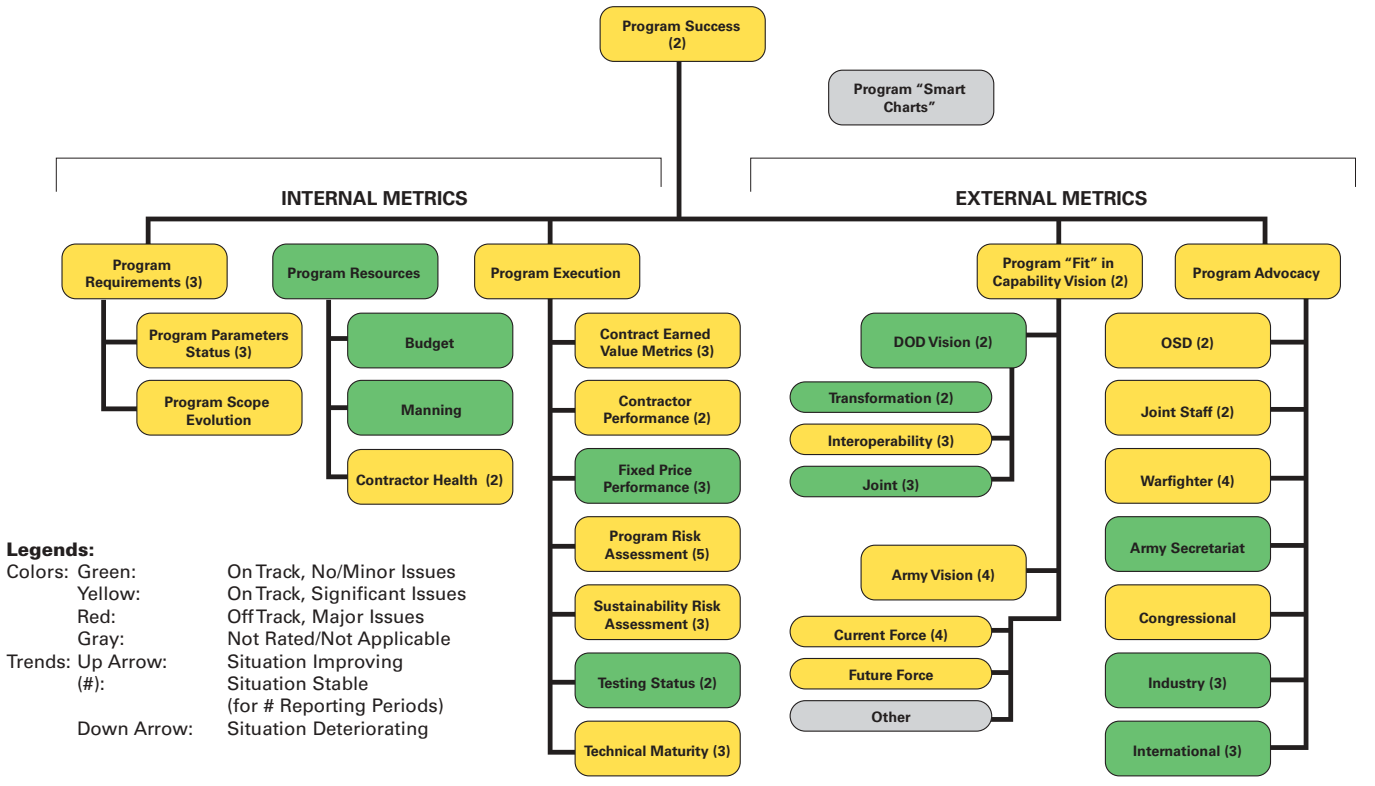

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also ensures cohesive and standard data submission across all applications.

The DAU P(S) Metric

The DAU method represents the overall P(S) as depicted in the figure. In this view, the 5 Level 1 factors and the 21 Level 2 metrics are represented in a work breakdown structure format. This view provides the P(S) metric for the program, color rating of the Level 1 factors and the Level 2 metrics along with trend data for the factors and metrics. The intent of this "windshield" is to provide the viewer an all-encompassing view of a program's health and an evaluation of its likelihood of success.

Three internal quantitative factors — requirements, resources and execution — and two external qualitative factors — program fit and advocacy — are used to determine the program's overall health. Internal factors are traditional program evaluation metrics that address cost, performance, schedule and risk and are largely within the PM's control. External factors are "environmental" factors that measure conditions critical to program success but usually fall outside the PM's direct control. Each metric is assigned an associated value with the factor's value equaling the total of the metrics aligned with the factor. The overall P(S) will equal the sum of the Level 1 factors.

Internal Metrics

Program Requirements. There are two Level 2 metrics in the requirements Level 1 factor. The *Program Parameters Status* metric is designed to evaluate the program's status in meeting the performance levels mandated by warfighters.

The *Program Scope* metric is designed to illustrate the degree of program risk inherent in overall program scope growth, from the time (pre-program initiation) where program scope was first determined to the present.

Program Resources. For the resources Level 1 factor, there are three Level 2 metrics. The *Budget* metric is designed to show the degree of risk inherent in the current budget state, both in current execution and looking forward through the Future Years Defense Program. It is similar in most respects to typical budget status charts used in program reviews. Where this metric departs from the typical budget representation is in the use and evaluation of budget sufficiency for each program appropriation. *Sufficiency* is defined as the degree to which the amount and phasing of each appropriation within a program retires programmatic risk. The *Manning* metric is intended to show key aspects of program office staffing. Manning is critical to the ability of any program to execute its responsibilities.

> *Sufficiency* is defined as the degree to which the amount and phasing of each appropriation within a program retires programmatic risk.

The *Contractor Health* metric provides an evaluation of the state of the contractor's business and its team to the PM, the PEO and AAE. This metric is broken into two areas. The first area, *corporate indicators*, identifies some of the more important metrics such as price-to-earnings ratio and history of stock dividends that the commercial world uses to evaluate contractor health. Additionally, the company's status in the defense industrial base for the particular program area, and any significant events with companywide impact, are identified and discussed. The second area, *program indicators*, speaks specifically to the assigned program/project team. This portion of the metric provides an evaluation of how well the contractor has set up the team executing the program along with any significant issues and challenges faced by the contractor.

Program Execution. The execution factor consists of seven Level 2 metrics as follows:

- The *Contract Earned Value* metric lays out cost-plus contract performance from an earned value perspective.
- The *Contractor Performance* metric provides the contractor's track record on developmental, cost plus-type contract vehicles by looking at the prior performance information history for the contract(s) in question, and the history of award fee increments provided to the contractor as compared to the amounts specified in the award fee plan.
- The *Fixed Price Performance* contracts require their own evaluation scheme. The fixed price performance Level 2 metric for fixed price contracts includes a Defense Contract Management Agency (DCMA) plant representative evaluation, a production/delivery profile graphic and a progress payments status.
- The *Program Risk Assessment* metric determines the program risk assessment covering all three internal factors. It is designed to provide a concise, 1-page summary of the key risks identified by the PM.
- The *Sustainability Risk Assessment* metric calls out the major areas in sustainability — which include, but are not limited to, the major elements in the program's logistics support analysis — to create the metric evaluation.
- The *Testing Status* metric is key to any program, both as an indicator of product capability and as a prerequisite for milestone approvals and budget release. This metric summarizes the program's

testing status along with identifying any significant testing issues for acquisition leaders.
- The *Technical Maturity* metric provides analyses of multiple major programs and shows the level of technical maturity possessed by each program at key stages of program conception, development and production. It is an excellent predictor of whether or not the program will meet established cost and schedule goals.

External Metrics

Program Fit. The first of the two external Level 1 factors is program fit within the capability vision. How well a program is supported in the larger service and the Office of the Secretary of Defense arenas is in large part determined by how well its product supports the specific capability vision(s) it is designed to meet.

Program Advocacy. The final Level 1 factor is program advocacy. *Advocacy* is defined as actual, tangible support for a program on the part of a senior advocate in a position to affect the priority of the level of resources received by a program.

Future versions of the P(S) business process will tailor metrics with consideration to the program's current lifecycle phase. As the next generation AIM is developed, particular emphasis will be placed on tighter integration of source applications reducing the PM's workload. Assessment and development of an enterprise-level solution is being refined by DCMA and DAU.

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Converting Legacy Drawings to 3-D Models

Dr. Raj Iyer and Pad Cherukuri

The engineering data for many Army combat and combat support vehicle systems remains mostly paper-based. Current vehicle systems will continue to be part of the Army Active or Reserve Component inventory or as part of the foreign military sales programs well into the 21st century. These systems need easily retrievable and stable product documentation for engineering support and maintainability. In April 1995, DOD set forth a management strategy for automated document conversion. This strategy centers on converting documents to an electronic or digital format and managing documents throughout their life cycle. The Army needs the capability to convert various documents to intelligent, editable 3-D solid models. This article discusses the U.S. Army Tank-automotive and Armaments Command's (TACOM's) initiatives to convert raster drawings to 3-D models and the resulting benefits and economic impacts.

Raster to 2-D Conversion

TACOM selected the M113 Family of Vehicles (FOV), high mobility multipurpose wheeled vehicle (HMMWV) (Figure 1), M1 and trailer systems, among others, for bulk conversion in FYs 99, 00 and 01. The part selection criteria used included a business case, administrative lead time and procurement lead time reduction, Armywide conversion value and decrease in weapon system ownership cost. As a result of this conversion program, 9,500 engineering drawings for M113A3 FOV, 6,500 HMMWV drawings, 3,800 M1 drawings and TACOM and Defense Logistics Agency spare parts and trailers were digitized into 2-D computer-aided design (CAD) files by the end of calendar year 2002.